



# AWA Newsletter

# 89

June 2013

Affiliated  
to the  
SARL



Antique  
Wireless  
Association of  
Southern Africa

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## AWA Committee:

- \* President—Richard ZS6TF
- \* Technical Advisor—Rad ZS6RAD
- \* Secretary/PRO—Andy ZS6ADY
- \* Western Cape—John ZS1WJ

## Reflections:

The open day at the Voortrekker Centre in Kempton Park was really a great success.

Thanks to some fine planning by the guys from KARTS, the venue was great, the weather was great and most of all the company there was excellent.

It was good to catch up with many old faces, some new ones and see what some people have been doing with themselves over the last year.

The display put on by many of the AWA members was really of the highest quality and the restorations that have been done have brought back some fine old rigs to pristine condition again.

It was certainly a great day with a great venue and we will certainly be involved

with KARTS again, if they will have us.

When I think back on the first open day we had way back in 2005, it was quite an organised event held for the first time at Rand Airport.

Alan Frantzen had spent quite a bit of time getting things together and the weather was as good as what it was this year.

The first open day, if I can remember correctly, was attended by about 100 people, at a rough count.

The first displays of our heritage radios were laid out with great pride in the main area, where it was held every year after that.

Numbers varied over the years, but the events were normally well attended.

We have had visitors from all over the country, having driven from Durban, to fly-

ing in from the North West Province.

Over the years, the AWA has established itself in the South African Ham Community right across the country, and has grown in strength and numbers every year.

Let it be said, that we are here to stay and not just a flash in the pan, or to put it in ham terms, a flash across the tranny.

Thank you to each and every one who has helped to make the AWA what it is. From the guys at the top, to the normal member who just takes part in calling in on the net.

Each one has a place in our organisation..

Here's to the next 10 years.

Best 73

DE Andy ZS6ADY

## WIKIPEDIA

A **triode** is an electronic amplifying vacuum tube (or *valve* in British English) with three elements: a heated filament or cathode, a grid, and a plate or anode. Invented in 1906 by Lee De Forest the triode was the first electronic amplification device, and the ancestor of other types of vacuum tubes such as the tetrode and pentode.

Its invention founded the electronics age, making possible amplified radio technology and long-distance telephony.

Triodes were widely used in consumer electronics until the 1950s, when transistors replaced them. Today their main remaining use is in high power RF amplifiers in radio transmitters and industrial RF heating devices.

The word is derived from the Greek τριόδος, *tríodos*, from *tri-* (three) and *hodós* (road, way), originally meaning the place where three roads meet.



High power triode used in pre-WW2 radio transmitter, in Berlin

## CW Net:

What an interesting month it has been on the CW front. There have been times when it seemed like things were really getting busy, and then all of a sudden, I could not raise a call from a soul.

There is often a bit of information flying around on the SARL Forum, of some CW interest, but I never seem to hear the guys posting threads on frequency.

It seems to me like the hams in SA have mostly got outside shacks, that is not in their main house, and the cold weather keeps them out of the shacks.

Personally, I have been trying to get out in to my shack as often as I can to make some calls on CW, possibly a lot more than working phone these days, but this last while, the band has been really quiet.

I do listen around on the DX bands for CW to hear what is happening out there, although I am

not a great CW enthusiast on the DX bands, it is always interesting to hear what is happening.

These days I am mostly hearing Europe and

Asia, although I do know that the US is usually very active on CW.

Maybe I am never in the shack at the right time to hear from Australia, NZ and Japan, with the time change maybe being the difference. I am usually in the shack in the afternoons.

Be that as it may, I will not become despondent about CW amongst SA hams. I know there is a very small fraternity that still exists and chooses to use CW in preference to any other mode, but the opportunity is always there for a good rag-chew and an exchange at a speed comfortable for you.

There have been a few new names to add to the AWA log book and that too is exciting. It may just be that there may be more of you thinking about joining us ?

Do listen out for us on the band and come in and say hello. It would be so good to hear many more of you on CW.

No matter what, there will always be someone there to answer your call on the AWA CW net.

DE ZS0AWA/CW ...--



## SSB activity:

Is it not amazing how quickly the bands change. A few months ago we were revelling in good conditions on the SSB net and enjoying good communications right around the country.

Now, recently, it has all changed and band conditions are wavering from good to poor.

Whatever it is, we are still recording call ins on the net that we have not experienced in a while.

Obviously, the topic of the day seems to be playing a big role in this increased numbers and there are many who would like to give their opinions on the various topics offered.

Average call in on the net has risen from 15 to about 25 per week. A record 32 calls were

recorded a week or two ago.

In this last weeks discussion, a recommendation to move the net frequency higher up in the allocated band was made, as 7070 seems to have become a fairly popular frequency for calling amongst many stations, and there have been times when we have to ask them to move so we can carry out the SSB net.

With all this in mind, there has been a suggestion to move the net to 7140. There were some reasons pointed out for using this frequency as ones slightly below are used for various emergency and maritime nets, so we would not like to be the ones to cause QRM to them.

This will only happen from the end of July if we do so. In the meantime, make sure your

rig and antenna you have has the ability of going to this section of the band. Please let us know if you have any objections to us moving to this segment of the band, whatever the reasons.



Heathkit HW 101

## AM:

Winter is really upon as the time allocated for us to use for the AM net has been severely shortened with the late sunrise and opening of 80m. Typically, the band only opens any time after 06:30 in the morning these days and leaves us with typically only an hour to play AM.

Not being too phased by this, there are still a fair number of stations active on the band at this time and with wavering conditions to start off, the band does seem to give us a lot of fair communication after sunrise.

Of course, it does mean one can stay in bed a bit longer, for those of us who don't enjoy early rising on a cold morning, while there are those who seem to still be up and about from long before sunrise.

I still cannot believe how many stations were active on AM with the Valve QSO Party a few weeks ago, and it just goes to prove, that AM can still be operated fairly successfully on the 40 and 80m bands.

Wednesday evenings, also really depend on the how much absorption is taking place in the D layer. Some evenings the band will work wonderfully, while on other evenings it will fade out at about 19:00 and conditions wont improve at all.

The only way to know if the band is open of course is to switch on your rig and try listening first to hear if there are any stations around, then try calling and see if you get an answer.

It really is like Tata ma chance, and when

you strike the jackpot, it really is rewarding.

If you are busy refurbishing an old AM rig or whether you are want ing to use your existing rig on AM, you'll enjoy putting it in to action and hearing the results on AM.



Collins 51J-4

# Strategies to Repair or Replace Old Electrolytic Capacitors

NOTE PLEASE: This web page provides information only; you are responsible for assuring that your repairs are safe, and that all repairs are carried out with proper safety. Tube-based equipment operates at *high voltage which can be lethal* and if you aren't totally confident in your ability to ensure your personal safety and the safe operation of your repaired equipment **please** take your amp, radio or test equipment to a qualified tech.

## What's Available for Repairs

Unfortunately, the selection of high voltage electrolytic capacitors today is both smaller and different from the past, so chances are you won't find an exact replacement for your original equipment electrolytics. For low voltage applications, like cathode bypass capacitors, most vintage types have an axial configuration, which is less common today but still available. The more modern radial configuration can also be used if their leads are long enough and they don't violate your notion of aesthetics.

More problematic are the high voltage power supply capacitors, usually multi-sectioned aluminum can types mounted on the chassis top plate. To repair these, you have perhaps four options:

- [Reform the Original Capacitors](#)
- [Buy and Install Chassis-Mount Replacements](#)
- [Buy and Install Under-Chassis Replacements](#)
- [Rebuild the Original Chassis-Mount Capacitors](#)



## Rap about Electrolytics

Electrolytic power supply caps likely constitute the single worst liability in old audio, radio and test equipment. By combining small size and very low cost per unit capacitance, electrolytic capacitors (hereafter called electrolytics) are the only cost-effective choice for high-value applications like power supply filtering in most consumer gear. However, electrolytics cannot be used for AC voltages (that is, no polarity changes allowed), and compared to other types of capacitors, their electrical characteristics are abysmally bad. They're less linear, have huge leakage and dielectric absorption, have very loose tolerances (like +/- 20% or worse) and have terribly short shelf and service lives compared to all other widely available capacitor types. If you want to learn more about the workings of electrolytic capacitors, here's a Nichicon application note (PDF format), [part 1](#) and [part 2](#), that covers the topic in depth.

Electrolytics do not suffer idleness well. They can cause big trouble when idle for long periods, needing periodic charging to stay "formed" and maintain the oxide layer that insulates the conducting plates. Sometimes they can be "reformed" by a slowly rising return to working voltage (see below). Even with regular use, electrolytics fail with age by drying out or leaking electrolyte following internal corrosion. If the electrolytic bulges, shows obvious loss of electrolyte, or simply can't be reformed you must replace it.

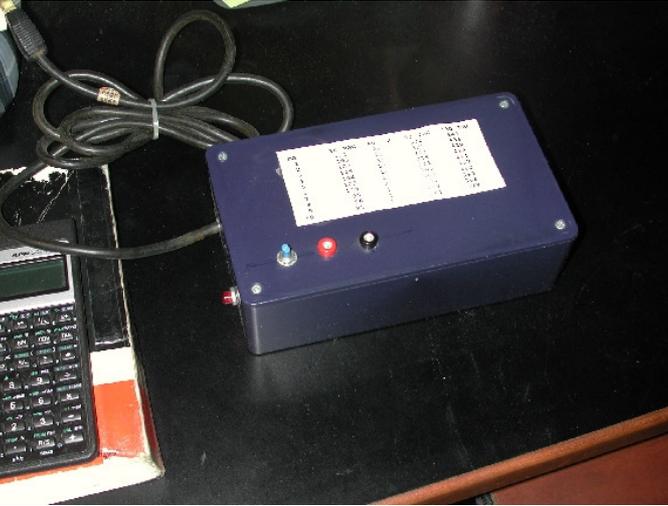
Note there are two types of leakage; physical and electrical. Since the electrolyte is a liquid or paste, when an electrolytic catastrophically fails it usually oozes some corrosive goop: physical leakage. Unlike an ideal capacitor, electrolytics slightly conduct when there's voltage across the plates: electrical leakage. Other than being a deviation from ideal behavior, the small leakage in a new electrolytic causes no major problems; as the electrolytic ages, the leakage increases. The leakage generates heat, which ages the electrolytic and increases leakage, causing more heat, and so forth. With enough leakage, the electrolyte boils, and the steam bursts the safety plug of the container causing physical leakage and signaling the demise of the capacitor.

Note also that there are other forms of terminal failure, including complete loss of capacitance (open) or bridging of the conducting plates (short). While you may be able to reform your 30 to 50 year old original electrolytics, they may not perform as well as when new. There may be a partial loss of capacitance, or there may be excessive leakage (the caps get really warm), or both. Unless you want to preserve the original condition of your amplifier, preemptive "recapping" may be the best course to restore the equipment to functionally original condition.

## Reforming

The thin layer of aluminum oxide formed to insulate the capacitor foil constitutes *formation*. Capacitor manufacturers use proprietary mixes of chemicals and DC electricity to create this insulating layer, which deteriorates with time and idleness. Often

the oxide layer is in such bad shape in older equipment that it must be *reformed* or else the capacitor will fail catastrophically. All methods of reforming use the slow reapplication of DC electricity to restore the oxide layer to its original thickness and uniformity. In my opinion, there's no one proven way to reform - many different approaches are available, but all have one element in common - slowness. The reforming must proceed faster than the buildup of heat due to the low resistance of the faulty oxide layer - this will at least take hours, and can take days.



**Voltage-Limited Method 1:** The voltage-limited methods use a handy device called the variable autotransformer (a.k.a. Variac, General Radio's brand name). Using a high-voltage external power supply, each capacitor is slowly brought up to working voltage by slowly raising the line voltage to the power supply. This can also be done with a variable DC supply with a range from about 50V to 500V, but variacs are cheaper and more common. A resistor can be placed in series to monitor the current, but watching the voltage also can reveal reforming progress; at each variac setting, the voltage will slowly rise until reforming at that voltage is complete.



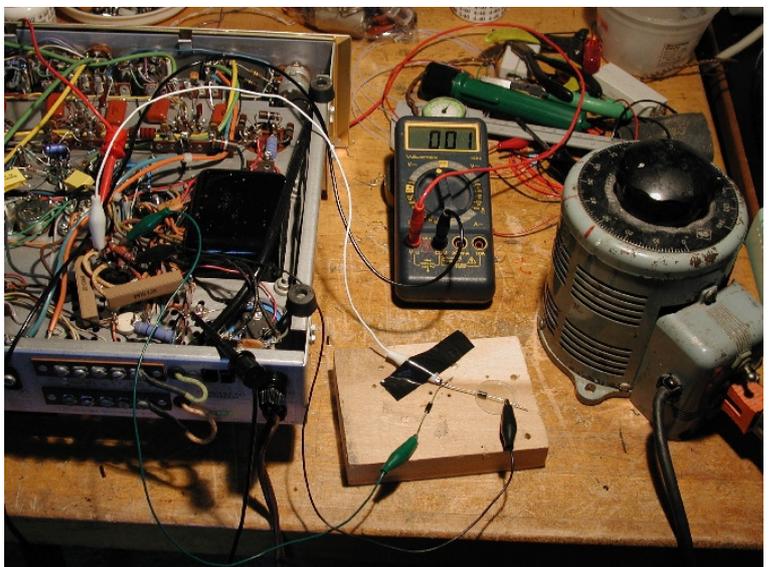
It's easy to make a supply for this purpose from junk-box parts; the circuit is a pair of 500mA 24V transformers connected secondary to secondary, followed by a voltage tripling circuit. Total cost was about \$10 (really), including the box from the local Radio Shack. Being a voltage tripler, regulation is weak and the voltage drops a lot as current increases. I've exploited this characteristic to give a rough estimate of the current drain, as shown in the chart on top of the supply. (The values were measured using a rheostat and my DMM - a supply using a different collection of parts would have similar behavior, but would measure differently). Typically I would connect my supply across the electrolytics to be reformed, along with my DMM set to its highest voltage setting. I plug my supply into the variac (turned off, set to zero), turn the variac on and slowly increase to the 30 volt setting. If the voltage reading on the DMM does not rise, or rises to less than 95 volts, there's likely a short. If the voltage rises, the voltage indicates the current drawn by the supply. As the capacitor starts to reform, the leakage current will decrease and the voltage will

continue to rise. Once the leakage has decreased to an acceptable level, I go stepwise upward with the variac setting until the operating voltage for the capacitor is reached.

In the equipment's chassis, often capacitors of different voltage ratings are connected by voltage-dropping resistors, and the equipment uses the current demands of the circuit to keep voltages in operating range. You could disconnect each capacitor from the circuit and reform individually, or perhaps follow method 2.

**Voltage-Limited Method 2:** Using a two stage method, we can use the load of the circuit to keep the voltages in all the circuit's power supply capacitors within operating range. This is the method that I usually use, and can be carried out by using the equipment's own power supply. Look at the circuit and note the lowest voltage rating of all the capacitors that connect to the high voltage (B+) supply. Remove the tubes from the chassis and, using a variac, reform the power supply capacitors to this lowest voltage. Now put the tubes in the chassis and raise the highest-voltage-operating capacitor to this minimum voltage. This typically gives about 60% of the B+ and enough of the filament voltage to provide a load. Raise the line voltage slowly (using your variac) to reform the resistor-connected power supply capacitors each to its own working voltage (or slightly above).

This method has some more risk compared to reforming out of the chassis - you'll need to watch the total current draw and raise the voltage more slowly, since you have less information about the condition of the individual capacitors. Remember that it's quite likely that all of the connected capacitors except one will reform, but that one bad section will draw lots of current. You *cannot* assume that, if the acceptable leakage for one electrolytic is 1 mA, then it's ok for 4 electrolytics connected together to have leakage of about 4 mA - your group of 4 electrolytics must have a combined leakage less than that allowed for a

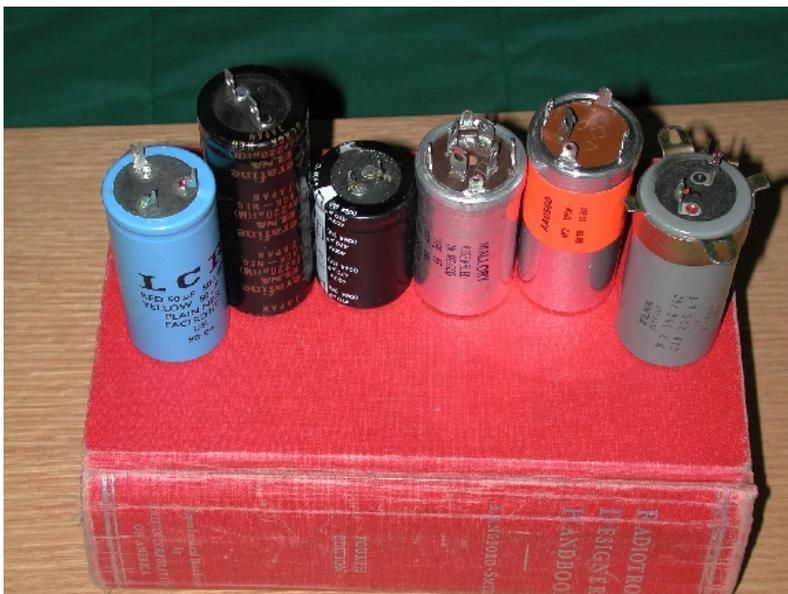


single electrolytic otherwise you've allowed the possibility of 3 of good quality and 1 clunker.

If the equipment has a vacuum tube rectifier, you must jumper it with some silicon diodes for this method to work. It's really easy though - remove the rectifier and use some clip leads and a couple of 1N4007s as shown in this picture. **WARNING** - this method obviously leaves wires exposed while you work. These wires are potentially at **HIGH VOLTAGES** which can kill. For example, if you rest your right hand on the variac (ground) and touch the exposed clip leads, that will form a circuit from one arm, through your chest, and down through the other arm - potentially causing cardiac arrest. To me, this seems no more hazardous than working around live tube equipment with the covers off, though extreme caution is warranted in both cases. Proceed at your own risk!

Some final cautions:

- *Excess Current:* you must keep a close eye on either the rate at which the voltage is rising, or you must measure the current directly while reforming. Either unsolder the connection between the rectifier and the capacitor and insert a current meter, or insert a resistor (while measuring the voltage across the resistor and calculating the current), or use the voltage drop across a resistor already correctly placed in the circuit to follow the current.
  - *Vacuum Tube Rectifiers:* These get their filament voltage from the same power transformer as the B+ supply. Thus, at the low initial voltages that you'd like to start the reforming at, they don't conduct. Observing the proper polarity, temporarily replace them with silicon diodes using an old tube base (with diodes soldered in place) or with diodes connected by clip leads.
  - *Over-Fusing:* To protect the power transformer while reforming, replace the usual 2 or 3 amp fuse with a very low value, such as 0.25 or 0.5 A. Your variac will prevent the turn-on surge that normally would open this sized fuse.
- Over Voltage for the Capacitors:* Be careful of the operating voltage when the tubes are removed from the chassis; without a load, the voltage delivered by the B+ transformer will be much higher than the normal operating voltage, and may exceed the capacitor's voltage rating.



### Chassis-Mount Replacements

As far as I know, there are three types of chassis-mount replacement available today; twist-locks (either new or vintage), computer caps and snap-mounts.

From left to right, we have a LCR computer capacitor, an Elna Cerafine computer type (unfortunately no longer in production), a Panasonic TSHA snap-mount capacitor, a new-production Aero-M twistlock, a NOS Mallory twistlock, and a good-but-used Elna removed from equipment.

**Twist-Locks** can be purchased NOS (new old-stock) through regular retail channels and at swap meets, from old electronic store stocks, and so forth. Most of these types have multiple sections (i.e. more than one capacitor in the can) and were built with many different combinations of sections in both capacitance and voltage rating. Last I heard, Aero M/Mallory had discontinued the production of replacement twistlock electrolytics, but a recent newsgroup post claimed that

production would be resumed if there were demand. Antique Electronic Supply presently has a limited stock. Good used twistlocks can sometimes be removed from old equipment or found at electronics swap meets.

Used or NOS replacements should be reformed before installation. Since the variety of good used or NOS types becomes more and more limited with time, you may have to settle for fewer sections than in the original capacitors. This needn't be a problem if you can hide the remaining sections in the equipment chassis. You can also accept replacements with higher capacitance than the original, by as much as 60% to 80% and perhaps more depending on the location in the circuit. Do not, however, use a replacement with a lower voltage rating than the original equipment (higher rating is ok, even desirable). Sections can also be paralleled to give higher capacitances; for instance, if you needed a 40/20/20/25uF@450/350/350/25V, and you found a 20/20/20/20uF@500/500/500/500V replacement capacitor, you'd wire two of the 20uF sections in parallel to give 40uF@500V, and use the two remaining 20uF@500V sections at 350V, then put a 25uF/25V capacitor in the chassis somewhere.

Replacement is straightforward, but make good notes about the wire locations before any unsoldering. Also pay attention to the locations of the ground lugs so that, when the new cap is installed, all the ground wires will reach their lugs.

**Computer Caps** vary in their height and diameter; if they can fit in your chassis, you may choose from many physical sizes for your project. Both screw terminal and lug (Faston type) connectors are used. Although many diameters and voltage ratings are available, we will focus on high-voltage computer caps with 1.3125" diameter and multiple sections. This diameter matches the usual diameter of twist-locks discussed above, and thus can be used for replacement without major equipment modification.



The blue plastic jacketed electrolytics made by LCR are discontinued (some stock is still out there), but similar capacitors continue to be produced by JJ Electronics in Slovakia. The black jacketed and audiophile-targeted Elna Cerafines have been discontinued, although audiophile targeted Black Gates can be purchased for outrageous prices, but I can't afford to own examples of those. For JJs, Triode Electronics, Angela Instruments, Parts Express. For Black Gates, Handmade Electronics, Angela Instruments, other parts suppliers on my home page. An example of my Scott 299C recapped with LCRs is shown on the right.

Mounting these caps requires a clamp screwed to the chassis, and you'll usually have to add some holes for the clamp attachment, and perhaps enlarge the clearance hole for the connection lugs. Clamps can be found at Mouser Electronics for about 50c. Typically, there are fewer sections compared to the original twist-locks, so some of the sections must be moved into the chassis.

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*(THIS ARTICLE WILL BE CONTINUED IN THE JULY ISSUE)*



Some fine homebrew examples made by Tim ZS6IM

## AWA OPEN DAY 01 JUNE 2013

On Saturday 01 June we joined with the Kempton Amateur Radio Club for an open day and flea market at the Impala Voortrekker centre in Allen Grove.

The Centre was a really great venue and lent itself to a great environment and ambiance that one could really enjoy.

The flea market area was on the veranda of the centre and the hall was used for the AWA display. There were some really great stalls with a great variety of Amateur products on sale.

The guys from KARTS put on a really good day and provided us with a great opportunity to put some of our fine radios on display.

An antenna was put up in the main square and Rad ZS6RAD ran the AWA SSB net from inside the display area.

Some great examples of Amateur Radio technology were on display, examples on previous page from



Tim ZS6IM.

A fine display of some Collins equipment from the war era was displayed by Richard ZS6TF with a video display giving the history of the radios.



The famed "Munro" AM rig designed and built by Munro ZS5IN was also on display, now owned by Ted ZS6TED.

This fine display of goods by Tony ZS6CCD was also there.



## President's Corner

By Richard ZS6TF

Thomas Edison 1804–96, the fourth most prolific inventor in history, held 1,093 US patents in his name, as well as many patents in the United Kingdom, France, and Germany. He is frequently quoted as saying “To invent, you need a good imagination and a pile of junk”.

So it is with a serious AWA member since most of the components required to repair, rebuild, and operate yesterday's radios and associated equipment faded from the manufacturer's catalogues between 30 and 70 years ago.

I think of my precious junk boxes not as a storage system but a retrieval system, meaning it's no good having something you need somewhere if it takes a day to unearth it.

I started from zero base, ie no radio Junk about 8 years ago, and after coming under the influence of antique radio gurus of various persuasions, I became painfully aware of my shortcomings in the junk department. Then, in a moment of reckless abandon I bid on a garage full of it in Middelburg and was surprised to be the highest bidder.

The moment of truth came when I had to load up two lifetimes worth of junk to haul back to Johannesburg. Fortunately I arrived in my Defender with a twin axle 3 ton trailer in tow, and after a whole morning's toil there was no room for a stray mossie in the Landy, and the trailer tyres had to be pumped up to a semblance of circularity for the return journey. Thus started a still unfinished process likened to panning for gold sorting out tons of ancient loot covered in free dust of decades.

But what sheer unadulterated pleasure, the like of which the XYL cannot begin to comprehend, and the financial criteria for such a venture shall forever remain secret from her. Of course I had junk boxes before this acquisition but they were set up to support my other time consuming hobby of vintage and classic cars.

The scene therefore was already set for integrating this massive influx of stuff in an orderly and searchable fashion. My junk-boxes have evolved into several flavours, from shoe boxes, wine cartons, pizza boxes, and ice cream tubs, aided by the bottoms cut off from 2 litre plastic milk bottles placed into cardboard beer trays to keep panel lights, fuse-holders, toggle switches, knobs, and male and female plugs from inadvertently mingling.

The HARDWARE junk box was well established already with BA screws separated from metric, nuts, washers, lock washers, spacers, springs, and plastic vitamin boxes for the smaller items, circlips, woodruff keys, grub screws, and all manner of obscure fixings and fastenings.

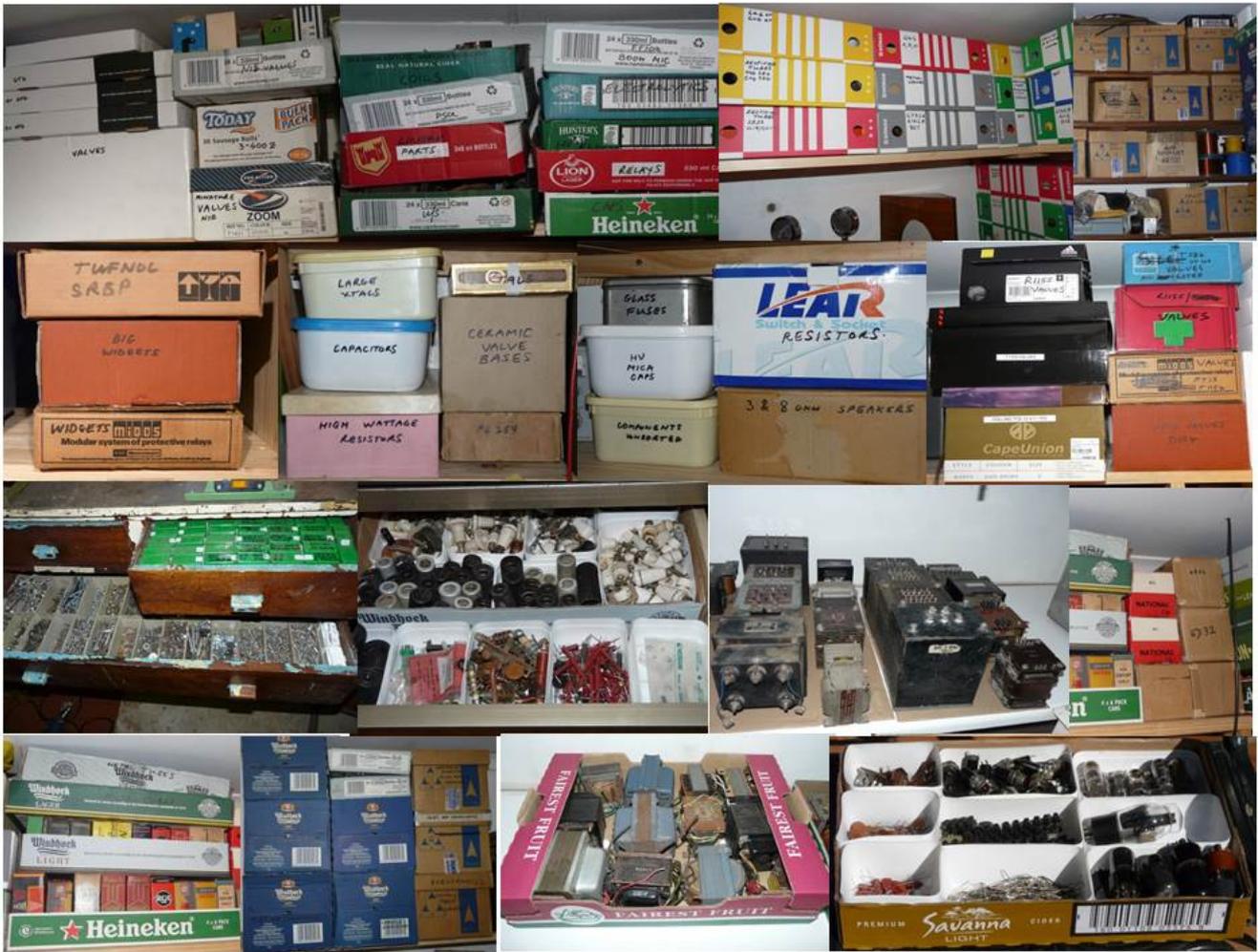
The ELECTRONICS junkbox was a scratch creation by combining loose components with those stripped from wannabe unfinished projects, and dead and donor equipment parts resulting from hours of happy harvesting, dismantling and discarding the carcasses and no-hoppers. I have a multitude of beer cartons containing old PCB's which are visited regularly to excise much needed components.

Originally the WIRE junkboxes were simply segregated into single and multicore, but with the advent of homebrew, there are now 6 boxes of various types of hookup wire, screened wire, and mains cable cut from dead appliances.

The MATERIALS junkboxes are now separated into steel, aluminium, brass and copper, sheet and stock although I tend to buy new for the larger and more visible projects.

The most important box is labelled WIDGETS ( now separated into large and small!) and contains all those odd bits of plastic and metal brackets, dooberies from dismantling appliances, things found on the dump, and anything else unidentified that look as though they could be useful and I am not quite ready to hurl out.

My valves are now reasonably well sorted and boxed and labelled where they are spares for equipment in the collection or for projects pending, but the rest seem to defy any rational system of order so the biggest boxes are labelled “Unsorted and not tested”.



My single handed efforts to reverse the entropy of the universe has resulted in some really satisfying projects at minimal cost. The possession of nice junk is not a golden staircase to paradise, but having a good one and networking with likeminded AWA junkbox custodians helps to maintain the legend that a radio amateur can do for ten bob (an ancient Rand) what others struggle to do for 5 Quid (sadly R62.60 at the time of writing), and maybe project 39a will be completed in my lifetime after all.



Some fine examples of beautifully restored rigs on display at the AWA open day

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[http://groups.yahoo.com/  
group/AWA\\_SA/](http://groups.yahoo.com/group/AWA_SA/)

**Antique Wireless Association  
of Southern Africa**

**Mission Statement**

Our aim is to facilitate, generate and maintain an interest in the location, acquisition, repair and use of yesterdays radio's and associated equipment. To encourage all like minded amateurs to do the same thus ensuring the maintenance and preservation of our amateur heritage.

Membership of this group is free and by association.

**Notices:**

A special word of thanks to Om Tubby ZS5CQD, for his kind donation of a collection of Hallicrafters and other radios that he has collected over the years.

In several emails between Tubby and the Editor, he expressed an interest in donating these radios to the AWA as he was moving to a smaller QTH.

Arrangements were made with Om Tubby and the radios were collected by Don ZS5DR and stored. We will be cataloguing all the equipment and looking to dispose of them at some of the flea markets for AWA funds.

Tubby also has a fine collection of military rigs that he is looking to dispose of.

**AWA 10th Birthday.**

For those of you who have been with us from the beginning, you may just remember that it was in March 2003 that the first meeting on air of the AWA of Southern Africa was took place.

Now it is 10 years later and we are celebrating 10 years of being on the air and many various activities that take place on air. In celebration of this, we have designed a special QSL card.

In order for you to get this celebratory QSL card, you need to contact ZS0AWA during one of the QSO parties, or activity days that take place during the year. That would be the CW activity day on the 3rd and 4th of February. The AWA QSO party on AM and SSB on the 11th and 12th May and the QSO party on the 12th and 13th October. Should you have a QSO with ZS0AWA on any of these dates, send us a QSL with a SASE and we will send you the QSL Card.